Journal of Cell and Animal Biology Vol. 3 (4), pp. 058-061, April, 2009
Available online at http://www.academicjournals.org/JCAB
ISSN 1996-0867 © 2009 Academic Journals

Full Length Research Paper

Prevalence of snail vectors of schistosomiasis and their infection rates in two localities within Ahmadu Bello University (A.B.U.) Campus, Zaria, Kaduna State, Nigeria

Ayanda, Opeyemi Isaac

Department of Biological Sciences, Covenant University, Ota, Nigeria. E-mail: ayandaisaac@yahoo.com. Tel.:+234 8030661295.

Accepted 23 March, 2009

648 snails comprising 392 (60.5%) *Bulinus globosus* (Morelet, 1866) and 256 (39.5%) *Biomphalaria pfeifferi* (Krauss, 1848) obtained from Samaru stream and ABU dam between April and September 2007 were examined for cercariae. Of this total, 355 snails were obtained from Samaru stream while 293 snails were obtained from A.B.U dam. 247 (69.58%) of the snails from Samaru stream were *B. globosus* and 108 (30.42%), *B. pfeifferi*. Similarly, 145 (49.49%) *B. globosus* and 148 (50.51%) were gotten from A.B.U dam. Two schistosomes were observed during the study; *Schistosoma mansoni* and *Schistosoma haematobium* with the former being more prevalent (20.31%) than the latter (18.37%). Occurrence of snails at each locality showed marked differences; *B. globosus* being more prevalent at Samaru stream and *B. pfeifferi* more prevalent at ABU dam. There was no significant difference in the comparison of means of prevalence in the two snails.

Key words: *Bulinus globosus*, *Biomphalaria pfeifferi*, *Schistosoma mansoni*, *Schistosoma haematobium*, Zaria.

INTRODUCTION

Schistosomiasis is a disease caused by infection with schistosome parasites. Schistosomes are important digenean parasites of humans and livestock. Globally, schistosomiasis ranks second among parasitic diseases of socio-economic and public health importance and is found in 48 African countries (WHO, 1999b). It is estimated that 200 million people are infected, of which 120 million are symptomatic and 20 million have severe disease. In 74 countries, 600 million persons are at risk of infection (Chitsulo et al., 2000; Gibodat, 2000; TDR, 1996). It is principally a disease of tropical and sub-tropical regions and is found in South and Central America, Africa, Asia and South - East Asia. Estimates suggest that 85% of all schistosomiasis cases are now in Sub-saharan Africa (Chitsulo et al. 2000). The disease is common in the Niger basin and is found in every country within the West African sub-region (Brown and Wright, 1985). In Nigeria, one of the most severely affected countries in Africa, it is estimated that 101.28 million people are at risk of infection while 25.83million are infected with *Schistosoma haematobium, Schistosoma mansoni* and *Schistosoma intercalatum* (Chitsulo et al., 2000). There are three main species of schistosomes infecting humans, *Schistosoma mansoni* and *Schistosoma japonicum* which inhabit the mesenteries around the intestine causing intestinal schistosomiasis and *Schistosoma haematobium*, which is found in the venules surrounding the bladder causing urinary schistosomiasis.

Vectors of schistosomiasis are the snails – *Bulinus globosus*, as intermediate host of *S. haematobium* and *Biomphalaria pfeifferi*, the intermediate host of *S. mansoni*. Comprehensive ecological researches on schistosome vectors in the Western and Northern parts of Nigeria started about two and a half decades ago, with the works of Asumu (1975) in Ibadan and environs and Tayo and Jewsbury (1978) in Malumfashi district of the then Kaduna State (now Katsina State). Several reports from various parts of Nigeria on human intestinal helminths include those of Awogun et al. (1995), Nwaorgu et al. (1998), Taiwo and Agbolade (2000) and Adeyeba and Akinlabi (2002). Urinary schistosomiasis due to *S. haematobium* infection is also endemic in many parts of Nigeria (WHO, 1993). Reports on it include those of Mafiana and Omotayo (1998), and Anosike et al. (2001).

Table 1. Monthly abundance of *B. globosus* and *B. pfeifferi* in Samaru stream and A.B.U. dam.

Months	*B. globosus*		*B. pfeifferi*	
	Samaru stream	A.B.U. dam	Samaru stream	A.B.U. dam
April	30	18	29	29
May	72	38	28	52
June	86	54	30	34
July	24	22	12	18
August	20	8	4	8
September	15	5	5	7
Total	247	145	108	148

These workers have contributed to the knowledge of the biology of snail intermediate hosts of schistosomes in those parts of Nigeria.

Certain drawbacks are associated with schistosomiasis control. Amongst these are fake distribution of single dose treatment drugs (Sulaiman, 1997), reduced sensitivity of schistosomes to the drugs (Bennet et al., 1997) and there is also the issue of drug resistant. Despite these, Nigeria is totally dependent on the use of single dose treatment drug for schistosomiasis control. According to Ukoli (1992), since schistosomiasis transmission tends to be focal, localized snail control can be undertaken to complement chemotherapy in reducing transmission. The snail intermediate host populations are influenced by temperature, food supply, predators, parasites, rainfall and water composition. Sunlight in snail habitats, flowering aquatic weeds, abundance of microflora and high dissolved oxygen content contribute to the abundance of freshwater snails (Hosea et al., 1998). This study was therefore carried out to determine the prevalence and intensity of cercariae in snail intermediate hosts, thereby providing information that can be utilized in designing a suitable programme for effective control of schistosomiasis.

MATERIALS AND METHODS

Zaria is an urban area, which has served as political, administrative and market centres for several hundreds of years. It is located on a plain about 3,520 km above sea level in the Northern Guinea Savanna of West Africa, more than 640 km from the sea. Zaria is located at latitude 11° 3N and longitude 7° 42 E. It has a tropical continental climate with distinct wet and dry seasons, most rain falling during the high sunny period from July to October (Mortimore, 1970). The mean annual rainfall is about 107.5 cm and mean daily maximum temperatures show a peak in April (36.6°C) and a minor one in October (23.3°C). Relative humidity values of about 70 - 80% (August) and 15 - 20% (December) have been recorded (Mortimore, 1970). Two snail species (*B. globosus* and *B. pfeifferi*) from two water bodies, Samaru stream and Ahmadu Bello University dam, both within the campus were studied. Apart from the availability of water which serves as a habitat for the snail intermediate hosts, various activities such as watering cattle, irrigation, fishing e.t.c also makes these sites human contact sites. Snails were collected from the banks of the two localities using a pair of long forceps and a scoop net attached to a long wooden handle. Where necessary, some snails were also hand-picked using a pair of gloves. Snails collected were transported to the laboratory in pre-labeled containers. In the laboratory, they were washed to remove dirt and identified using DBL-WHO (1980). They were then put in Petri dishes containing known water volumes separately. The Petri dishes together with the snails were exposed to bright light from a hundred watts electric bulb for about an hour to induce shedding of cercariae where present. Where no cercariae were shed, snails were crushed in water and examined. Cercariae found were immobilized using glacial acetic acid and counted with the aid of microscope. Mother sporocysts found were also counted. The numbers of the former and latter were separately recorded. Their identities were determined according to the methods of Hira and Muller (1966), Okwusa (1979) and Akufongwe et al. (1995).

RESULTS

A total of 648 snails, comprising 392 (60.5%) *B. globosus* and 256 (39.5%) *B. pfeifferi* were examined (Table 1). Of this total, 355 snails were collected from Samaru stream while 293 snails were collected from A.B.U dam. 247 (69.58%) of the snails from Samaru stream were *B. globosus* and 108 (30.42%), *B. pfeifferi*. Similarly, 145 (49.49%) *B. globosus* and 148 (50.51%) were collected from A.B.U dam. Two species of schistosomes were observed during the study; *S. mansoni* and *S. haematobium*. *S. mansoni* was more prevalent (20.31%) than *S. haematobium* (18.37%) although the population of *B. globosus* was higher than that of *B. pfeifferi*. The abundance of both *B. globosus* and *B. pfeifferi* (per month) at the dam and Samaru stream is shown in Table 1. For every collection made, *B. pfeifferi* was less in number than *B. globosus* in Samaru stream while the reverse was the case in the dam where the population of *B. pfeifferi* was higher than *B. globosus*.

Tables 2 and 3 show the monthly infestation data of schistosome cercariae in *B. globosus* and *B. pfeifferi* respectively. There was a slight difference in the monthly distribution of both species. There was no particular trend in the variation of prevalence and mean intensities of infection in both snail species. The prevalence and mean intensity of infection of snails were low relative to the population of snails and number of cercariae and mother

Table 2. Summary of monthly infestation data of schistosome cercariae and mother sporocysts in *B. globosus*.

Month	No. of snails examined	No. of snails infected with cercariae	No. of cercariae	Mean intensity of infection with cercariae	No. of snails infected with sporocysts	No. of sporocysts	Mean intensity of infection with sporocysts	Total no. of snails infected	Prevalence (%)
April	48	6	148	24.7	2	4	2	6	12.5
May	110	18	168	9.3	12	36	3	18	16.4
June	140	28	532	19	10	22	2.2	28	20
July	46	10	242	24.2	4	8	2	10	21.7
August	28	10	60	6	-	-	-	10	35.7
September	20	-	-	-	-	-	-	-	-

Table 3. Summary of monthly infestation data of schistosome cercariae and mother sporocysts in *B. pfeifferi*

Month	No. of snails examined	No. of snails infected with cercariae	No. of cercariae	Mean intensity of infection with cercariae	No. of snails infected with sporocysts	No. of sporocysts	Mean intensity of infection with sporocysts	Total no. of snails infected	Prevalence (%)
April	58	2	14	7	4	8	2	4	6.9
May	80	14	248	17.7	8	20	2.5	14	17.5
June	64	14	142	10.1	10	22	2.2	14	21.9
July	30	10	42	4.2	8	22	2.75	10	33.3
August	12	4	60	15	2	6	3	4	33.3
September	12	6	20	3.3	-	-	-	6	50

sporocysts per snail respectively. The snail populations were highest in May and lowest in August. During the months of May and June (prolonged dry season due to late arrival of rains), more snails were collected whereas with increased rainfall starting from July, snail populations decreased. Student's t-test analysis used to compare the differences in the means of the prevalence of infection between *B. globosus* and *B. pfeifferi* showed that there was no significant difference.

DISCUSSION

Zaria experiences two climatic seasons; the dry season (October to April) and the wet season (May to September). This study does not include data for both seasons because the bulk of the work was carried out during the rainy season. The low snail population observed in April (which is the end of the dry season) could be attributed to low water level at the study areas. The highest population density of snail was recorded in May. This may be due to the late coming of the rains and probably intervening long dry periods even after starting. This observation agrees with that of Etim (1998) that snail populations fluctuated strongly decreasing at the peak of rainy season.

The preference for different environmental conditions such as abundant microflora, oxygen content and other physico-chemical factors could be one reason why the snail populations showed marked differences in each locality. Another factor could be the natural behavioral mode of adaptation which is different for each species. *B. pfeifferi* is a quiet water, surface feeding snail and could be washed down to the dam easily. It finds a resting place when the speed of water current becomes greatly reduced whereas *B. globosus* can cling to or settle to the bottom of the water and later come out to the surface. This would be made easier by the rocky nature of the substratum or bed of the Samaru stream. Also, according to Hira (1966), large numbers of *B. globosus* occurred in habitats that were slightly polluted with faeces or decaying vegetation. Careless discharge of effluent, piggery and domestic wastes may be another reason why more snails were recorded at Samaru stream. Though there was no particular trend in the variation of prevalence, it could be said from the result that increase in snail populations may result in an increase in the infection of humans by schistosome cercariae with increased human-water contact activities. Although mortality due to schistosomiasis may be low, the disease imposes a heavy burden upon the health and well being of individuals

(WHO, 1985). The mean intensity of infection was relatively low for both snail species. The number of cercariae counted per snail was considerably low. It may be that at the time of crushing the snails, the cercariae within the sporocysts had not reached maturity (4 - 6wks) by which time cercariae begin to emerge from a birth pore near the anterior end of the mother sporocyst (Smyth, 1976). Faust and Hoffman (1934) observed that a snail infected by a single miracidium of *S. mansoni* discharged an average of 3,500 cercariae a day for a long time. In one instance, the total progeny of a single miracidium exceeded 200,000. Given this observation, it is surprising that the cercariae found in this study were few.

Although the period of study was not too long, hence more information on the pattern of prevalence of infection and distribution of snail intermediate hosts can yet be provided. However it would be advisable based on the results that a combination of educating the population using the water bodies for various activities on the dangers on contact with the water bodies, prophylactic treatment by mollusciciding the water in the middle of the dry season when the streams are still flowing but at a low level and speed according to Madsen (1985) and chemotherapy would go a long way in curbing the disease.

REFERENCES

Adeyeba OA, Akinlabi AM (2002). Intestinal parasitic infections among school children in a rural community, southwest Nigeria. Nig. J. Parasitol. 23:11-18.

Akufongwe PF, Donji B, Okwuosa VN, Dakul DA, Ntonifor HN (1995). Observed disparity on schistosome infection rate in field *Biomphalaria pfeifferi* (Kraus) between two area of the Jos metropolis, Nig. Parasite. 2: 89-91

Anosike JC, Okafor FC, Onwuliri COE (1992). Urinary schistosomiasis in Toro Local Government Area of Bauchi state, Nigeria. Helminthologia 29: 177-179

Anosike JC, Nwoke BEB, Njoku AJ (2001). The validity of haematuria in the community diagnosis of urinary schistosomiasis infection. J. Helminthol. 75: 223-225.

Asumu DI (1975). Studies on the Biology of snails and their larval trematodes in Ibadan freshwater systems. PhD Thesis, University of Ibadan, Ibadan. 440p

Awogun IA, Okwerekwu FEO, Oyawoye OA, Bello AB (1995). Helminthic infections and anaemia among pregnant women attending antenatal clinic in Ilorin, Nigeria. Biosci. Res. Comm. 7:41-45.

Bennet JL, Day T, Feng-Tao L, Ismael M, Farghaly A (1997). The development of resistance to antihelmintics: a perspective with an emphasis on the antischistosomal drug, praziquantel. Exp. Parasitol. 87: 260-267

Brown DS, Wright CA (1985). *Schistosomiasis: Bilharzia*. In: The Niger and its Neighbors: Environmental History and Hydrology, Human use and Health Hazards of the Major West African River. A. T. Grove (Ed). A. A. Balkema Publishers, Netherlands. pp. 295-317.

Chitsulo L, Engels D, Montresor A, Savioli L (2000). The global status of schistosomiasis and its control. Acta. Tropica. 77: 41-51

Danish Bilharziasis Laboratory (DBL), (1980). A practical guide to the identification of Fresh Water snails. DBL in collaboration with WHO. p. 24

Etim SE (1998). The epidemiology of urinary schistosomiasis in Biase area, Cross River State and its implications for control. The Nig. J. Parasitol. 19: 77-83

Faust EC, Hoffman F(1934). Studies on *Schistosoma mansoni* in Puerto Rico, I-III. Puerto Rico J. Public Health Trop. Med. 9:154-160, 228-254.

Gibodat M (2000). Post-transmission schistosomiasis: a new agenda. Acta Tropica 77: 3-7

Hira PR, Muller R (1966). Studies on the ecology of snails transmitting urinary schistosomiasis in Western Nig. Annals. Trop. Med. Parasitol. 60: 661-672

Hosea ZY, Ogbogu VC, Agbede RIS (1998). Snail distribution and habitat preferences in Zaria area, Nigeria. Paper presented at 22nd annual conference of The Nigerian Society for Parasitology on the 4th-7th Nov., 1998 at the University of Benin, Benin City, Nigeria. p. 33

Madsen H (1985). Ecology and control of African freshwater pulmonate snails. Part 1: life cycle and methodology. Danish Bilharziasis Laboratory, Charlottenlundi, p. 36.

Mafiana CF, Omotayo AB (1998). Urinary schistosomiasis: An evaluation of microscopic egg count and chemical reagent strip in children in south-west Nigeria. Helminthologia 35: 31-35.

Mortimore MJ (1970). Zaria and its region. Occasional paper No. 4. Department of Geography, A.B.U. Zaria

Nwaorgu OC, Okeibunor J, Madu E, Amazigo U, Onyegegbu N, Evans D (1998). A school-based schistosomiasis and intestinal helminthiasis control programme in Nigeria: acceptability to community members. Trop. Med. Int. Hlth 3: 842-849

Okwuosa VN (1979). The Ecological studies of freshwater snails with particular reference to schistosomiasis Vectors in Lagos and Ogun State of Nigeria. Ph.D Thesis, University of Ibadan. p. 300.

Smyth JD (1976). Introduction to Animal Parasitology. 2nd (Ed). Hodder and Stoughton, London. pp 196-197

Sulaiman MS (1997). Counterfeit praziquantel. Lancet 1: 5

Taiwo AK, Agbolade OM (2000). Intestinal helminthiasis among school children in Oru, Ogun State, Nigeria. Nig. J. Sci. 34: 283-286.

Tayo MA, Jewsbury OM (1978). “Changes in snail population following construction of dams” Annals. Trop. Med. Parasitol. 72, (5)

TDR (1996). Schistosomiasis, 13th programme report. UNDP/WORLD BANK/WHO Special Programme for Research and Training in Tropical Diseases. pp. 62-71

WHO (1985). The control of schistosomiasis. WHO Medical Report Series. 728:13

WHO (1993). The control of schistosomiasis: second report of the WHO Expert Committee WHO Technical Report Series, No. 830.

WHO (1999b). Report of the WHO informal consultation of schistosomiasis control. Geneva December 1998 WHO/CDS/SIP/99.2